**FIG. 1**

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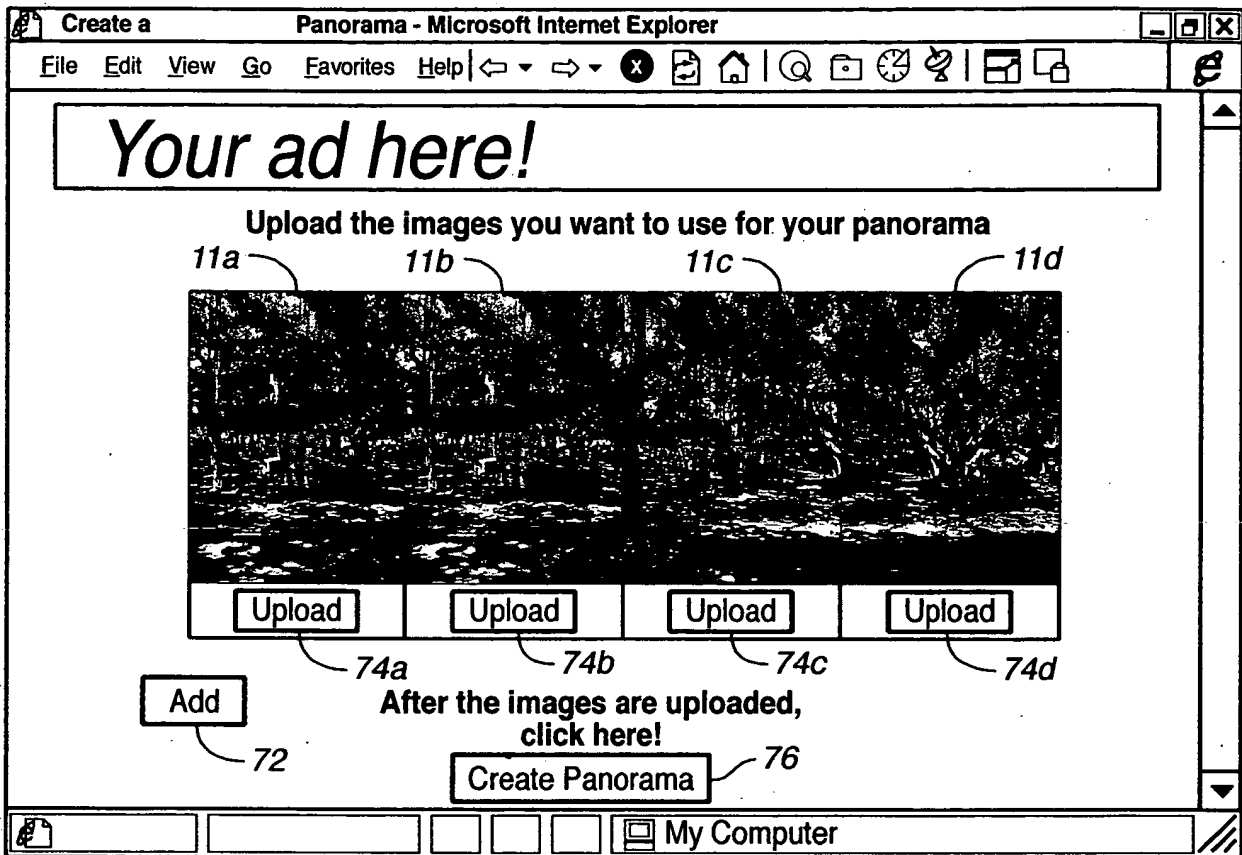
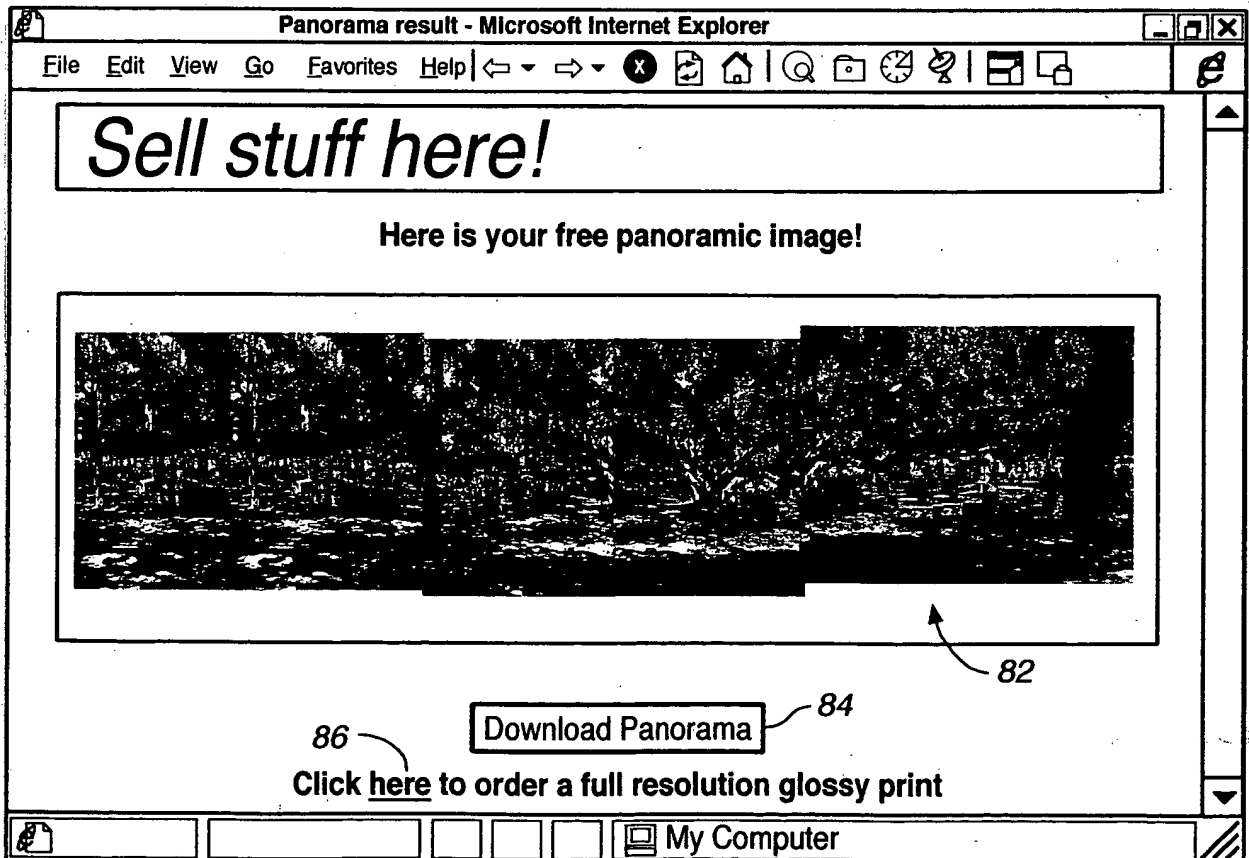


FIG. 2A

70



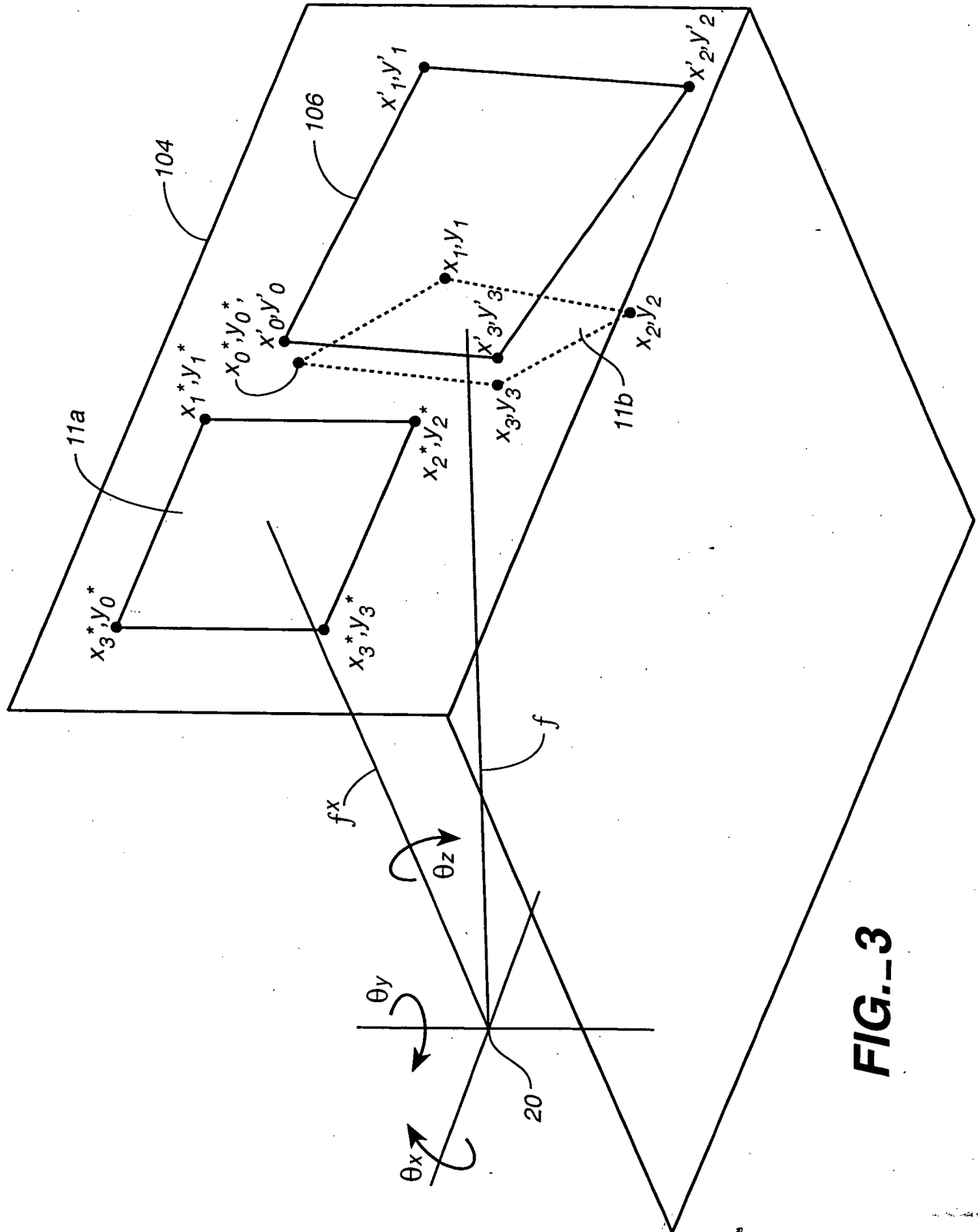
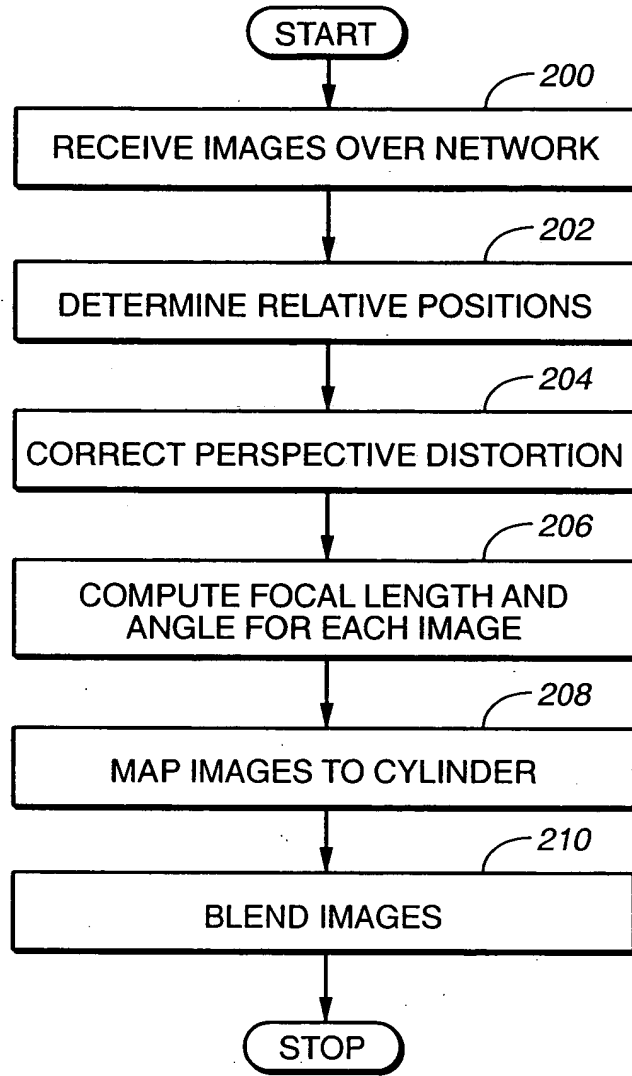
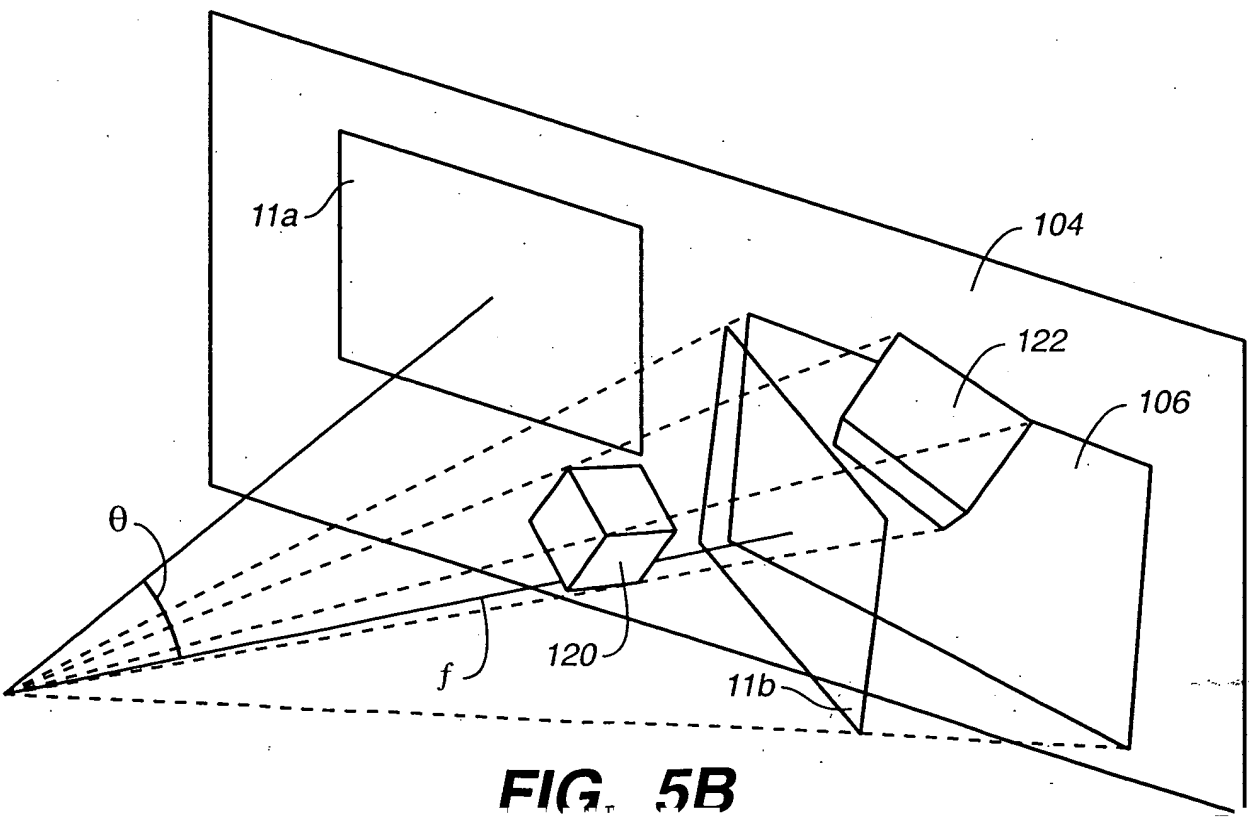
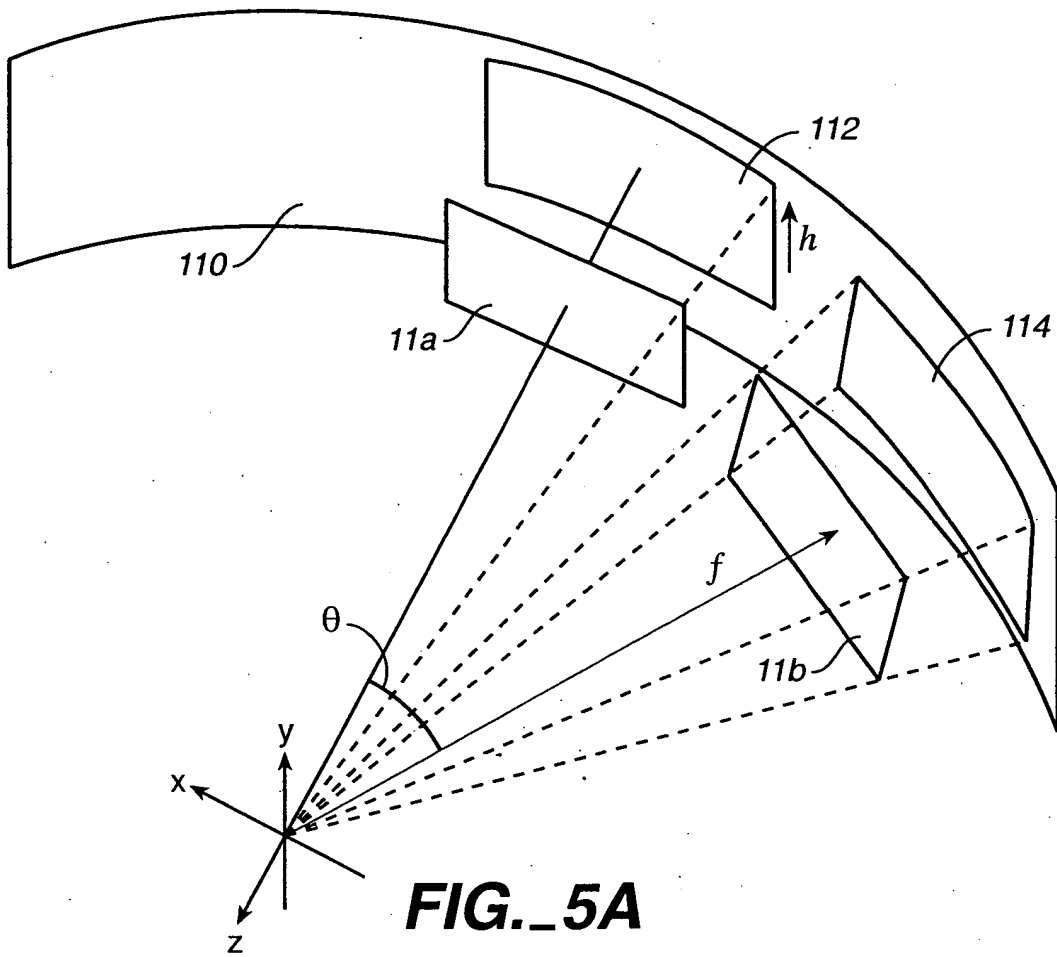


FIG.-3

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**FIG. 4**

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+

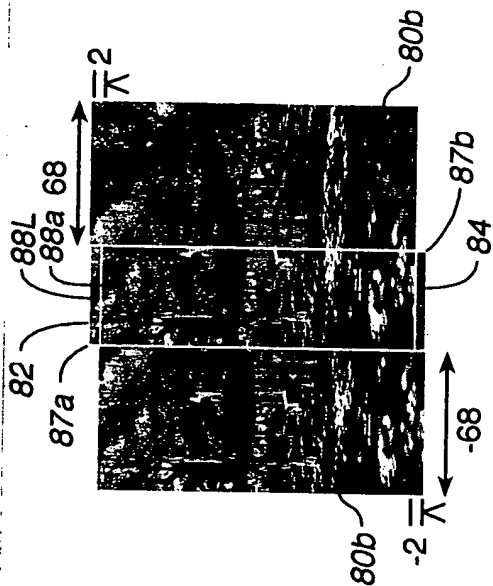


FIG. 6A

FIG. 6F

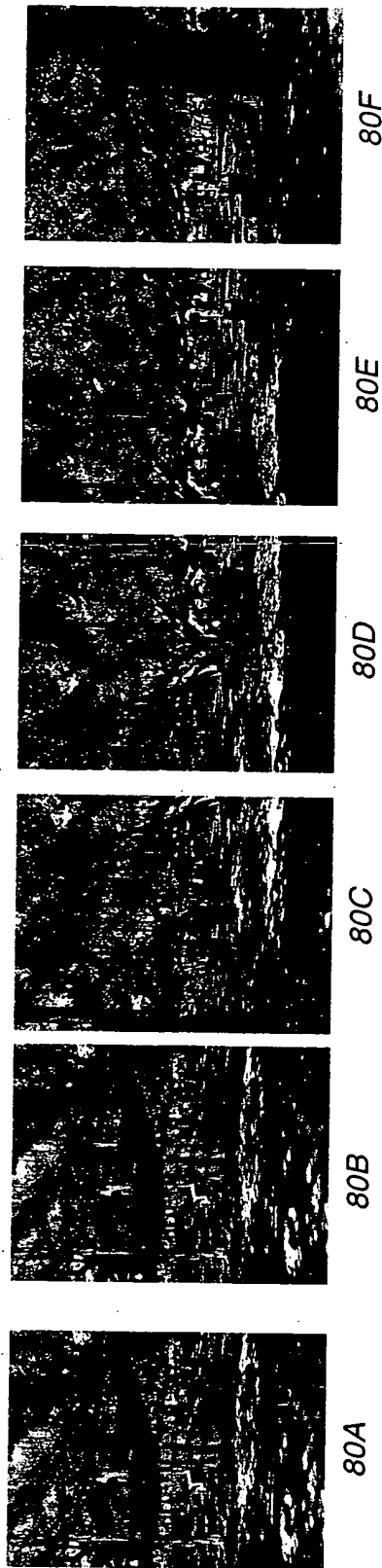
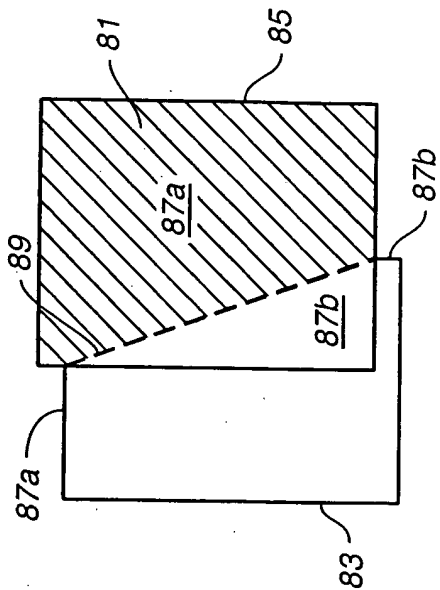
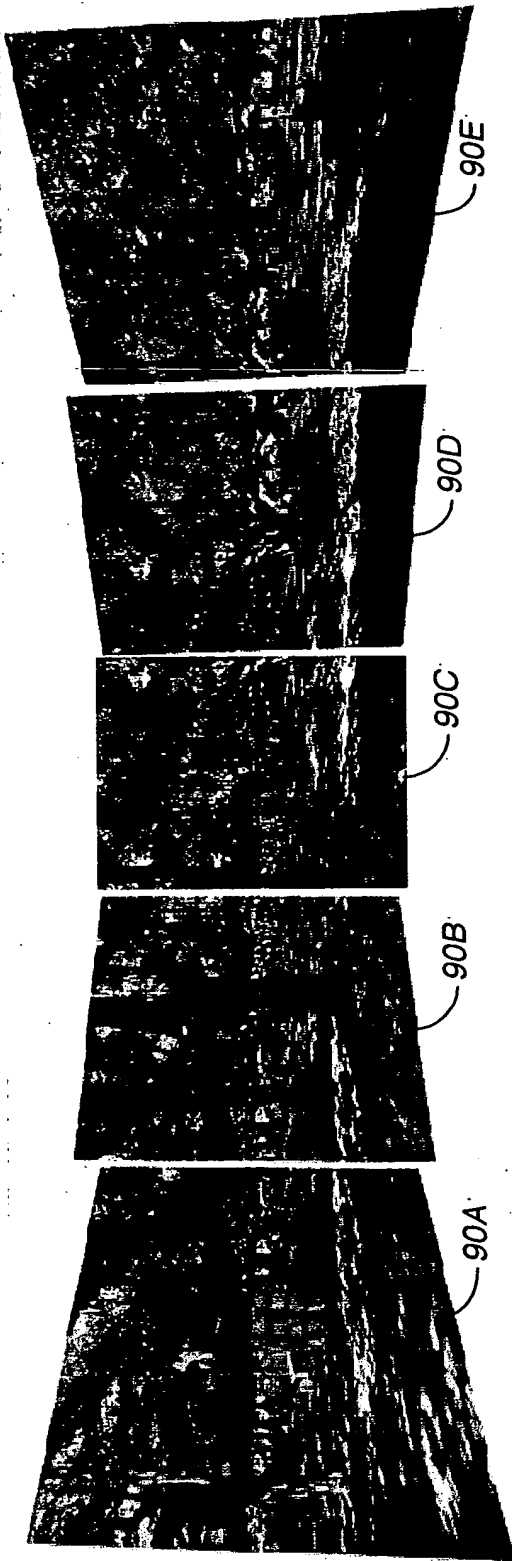


FIG. 6B

Adjacent Lists

86A	86B	86C	86D	86E	86F
B: 68, 2	A: -68, -2 C: 69, 4	B: -69, -4 D: 66, -1	C: -66, -1 E: 66, -1	D: -66, 1 E: 67, -2	E: -67, 2

FIG. 6C



Select C as "base"
Align B, D to C
Align A to B and E to D

FIG._6D

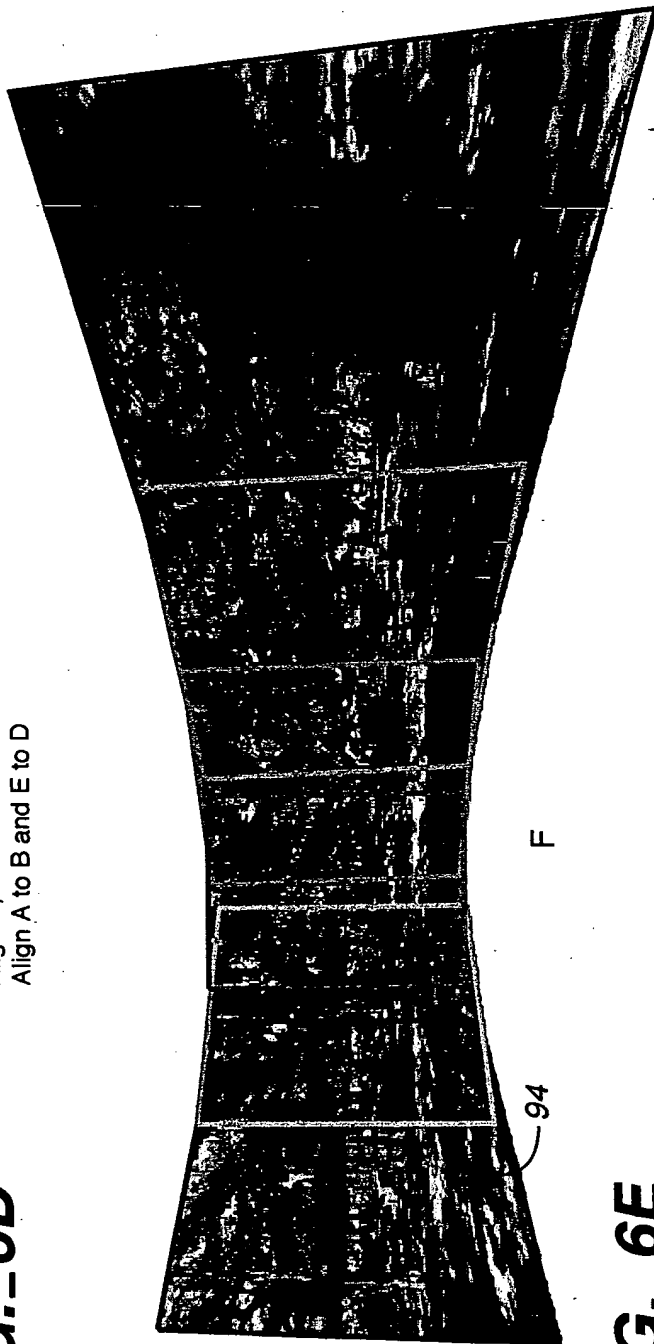


FIG._6E

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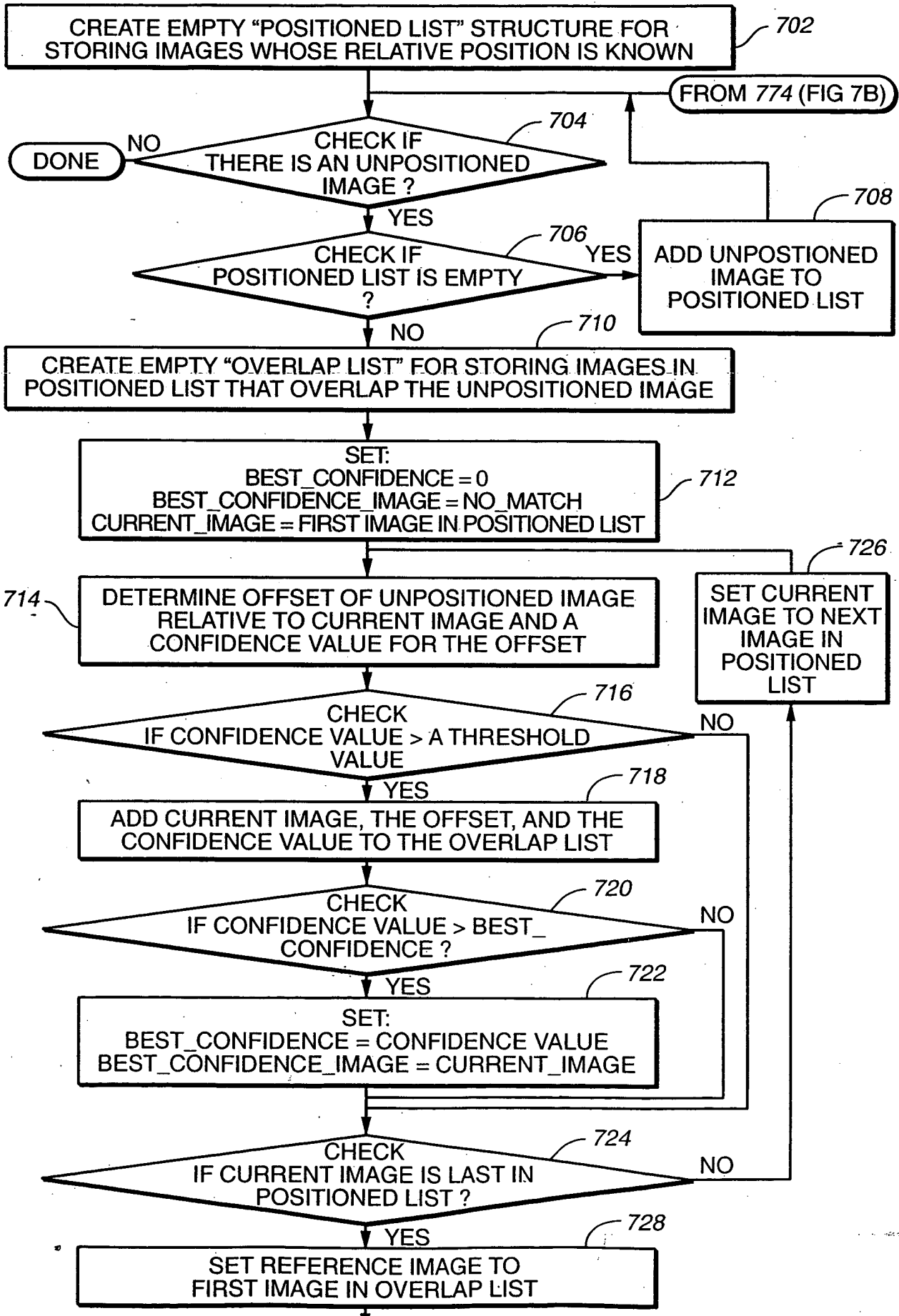


FIG. 8 - 20000000

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FROM 728 (FIG 7A)

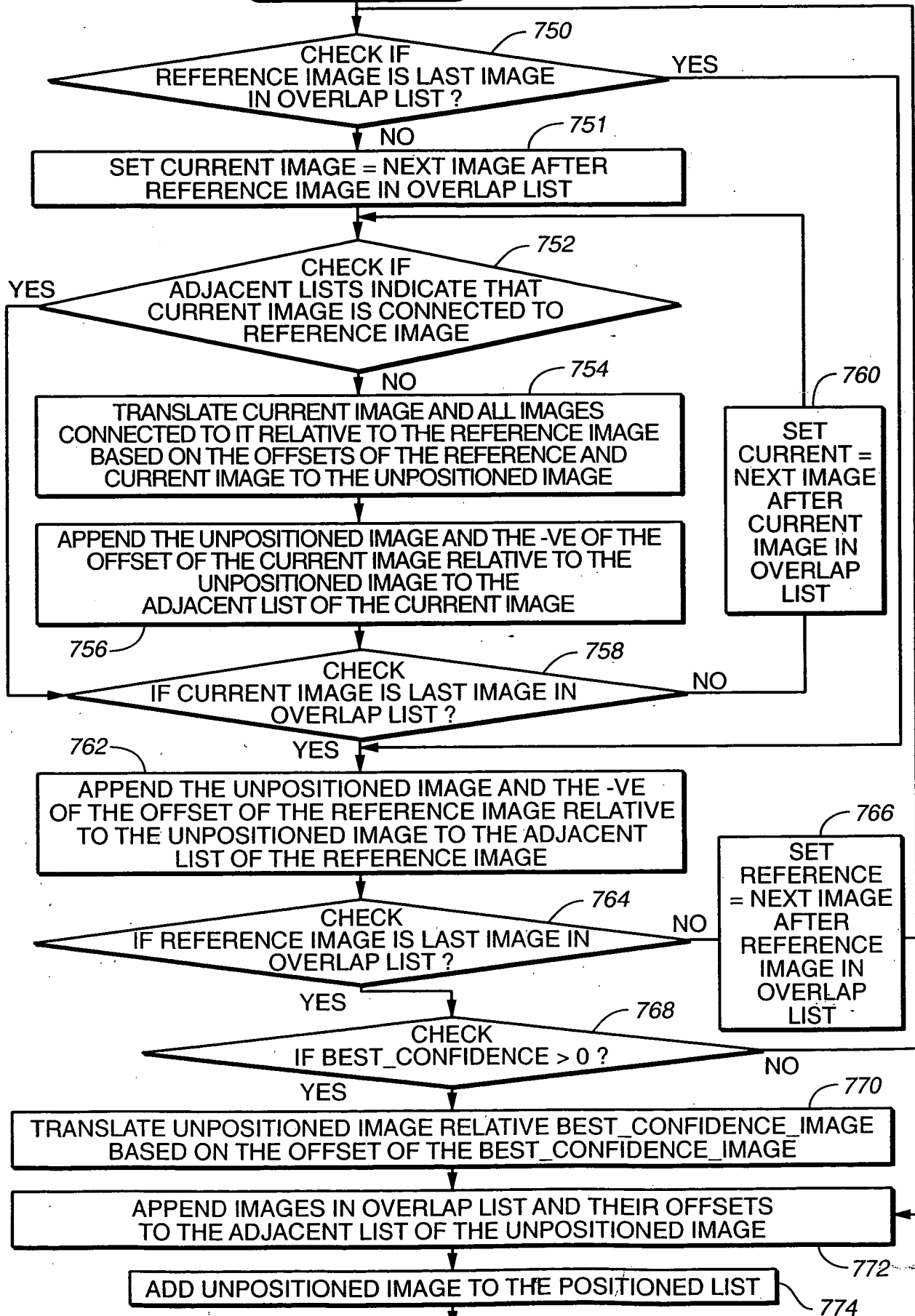


FIG. 7B

(GO TO 704 (FIG 7A))

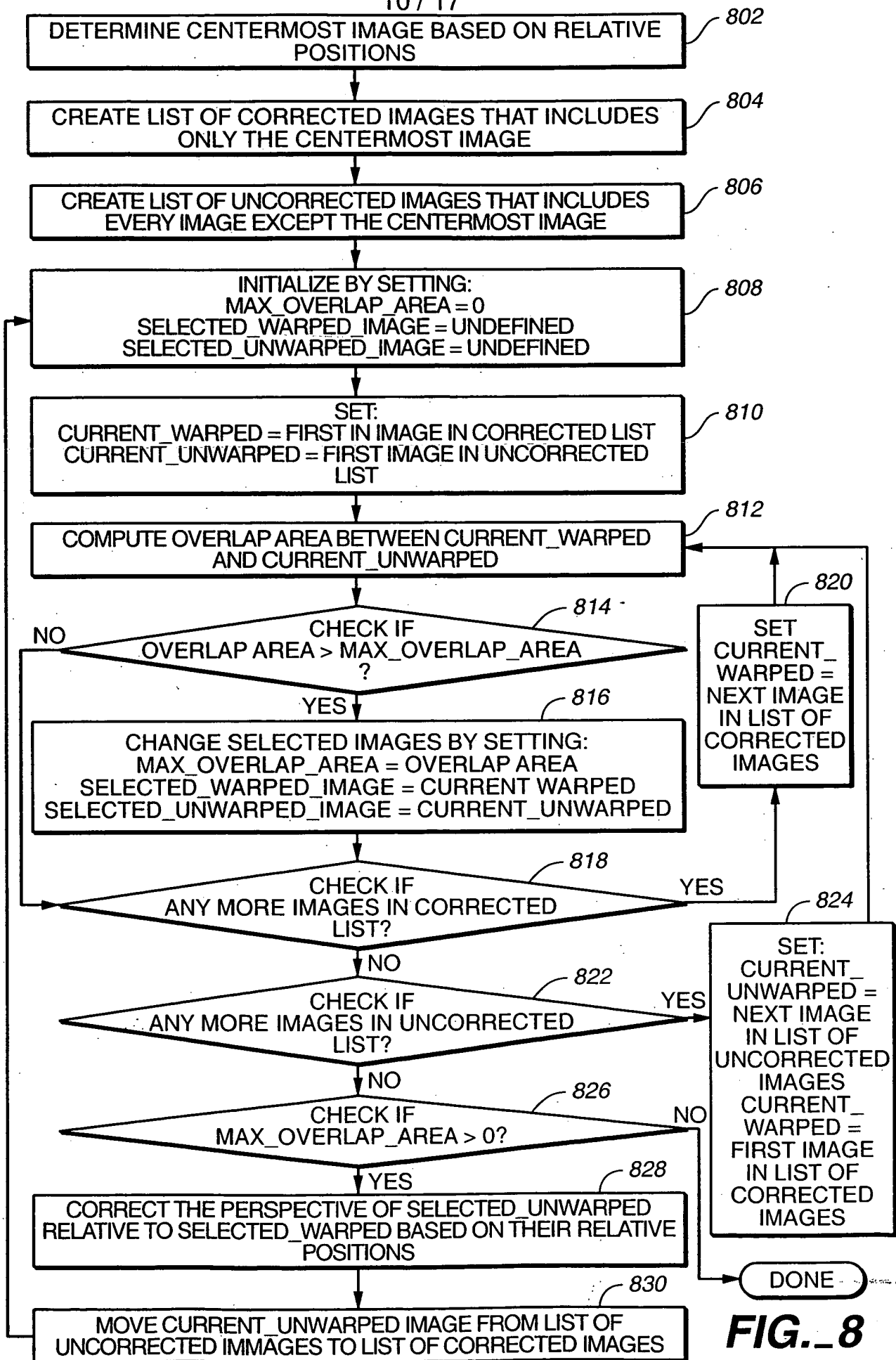


FIG. 8

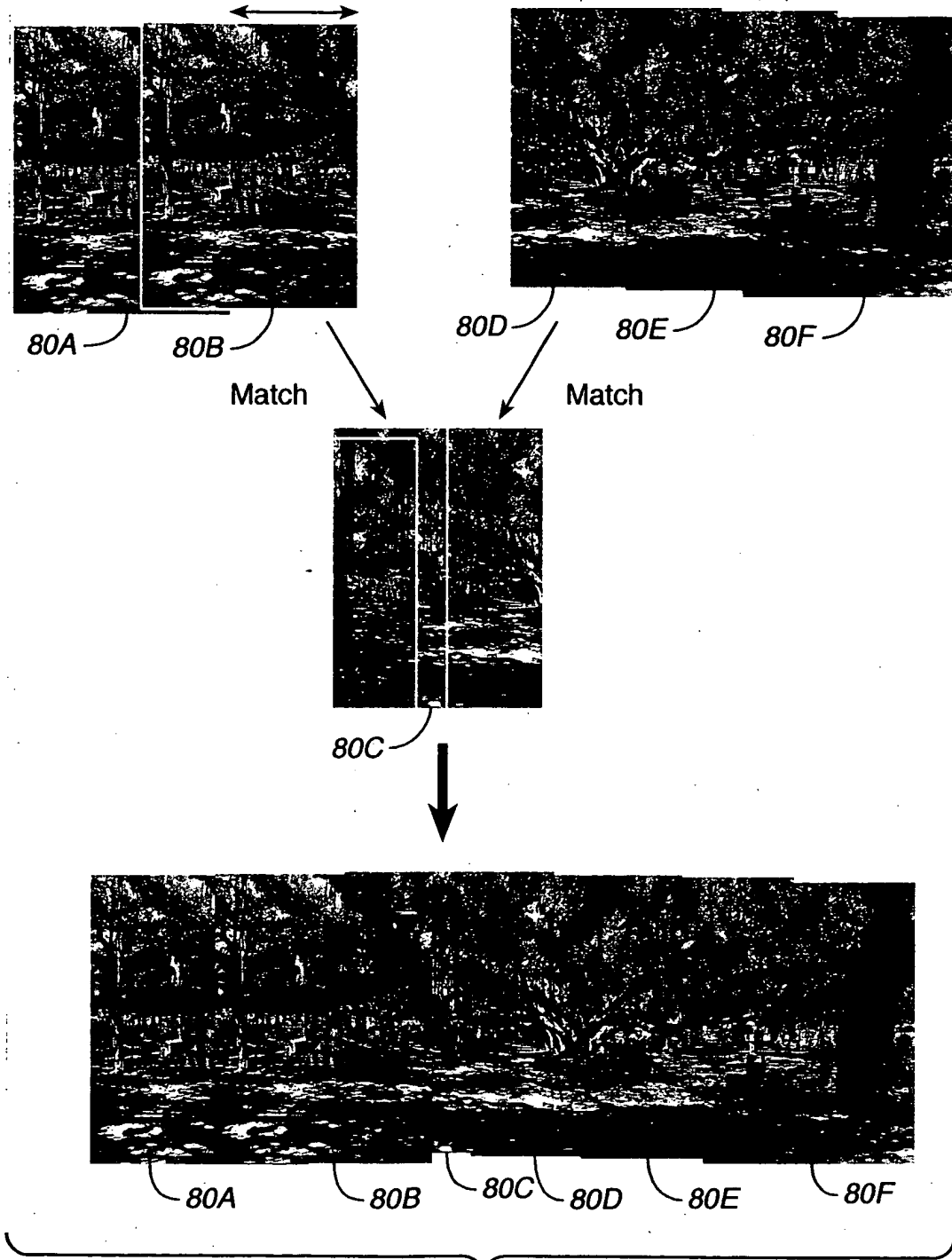


FIG._9

00848017-070501

Original Image

	2-D coordinates	4-D coordinates
Vertex 0	(x_0, y_0)	$(x_0, y_0, 0, 1)$
Vertex 1	(x_1, y_1)	$(x_1, y_1, 0, 1)$
Vertex 2	(x_2, y_2)	$(x_2, y_2, 0, 1)$
Vertex 3	(x_3, y_3)	$(x_3, y_3, 0, 1)$
The i^{th} vertex	(x_i, y_i)	$(x_i, y_i, 0, 1)$

130
132

134

FIG._10A

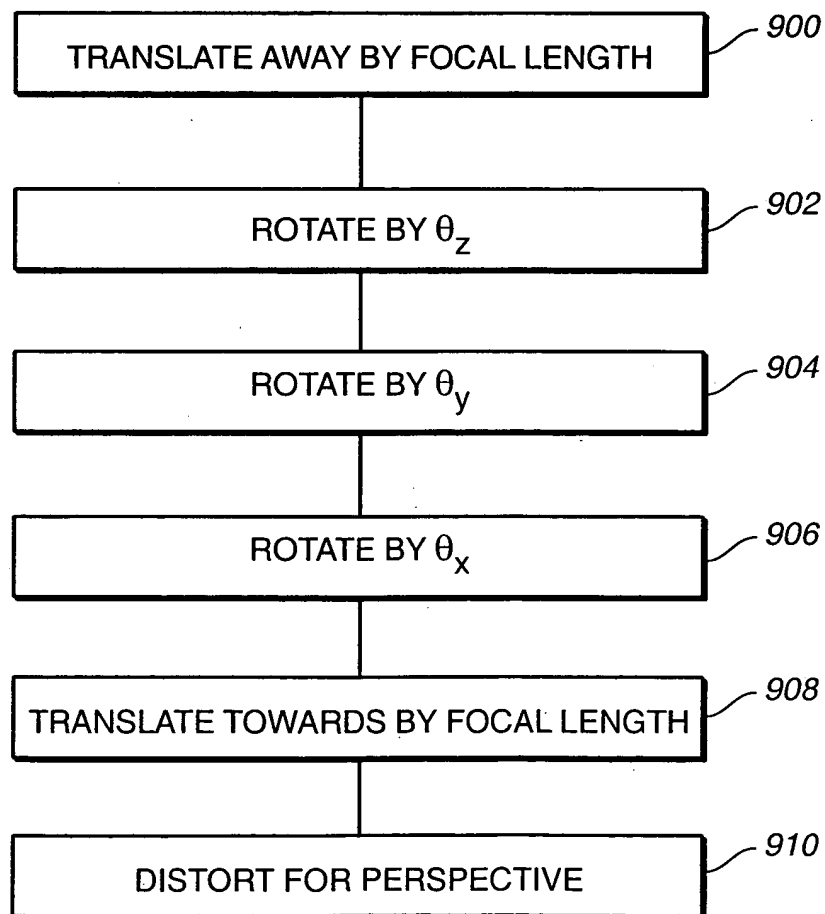


FIG._10B

T09020" 2T081250

Perspective Correction Transformation

1. Translate outwards:

$$T_a = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & f & 1 \end{bmatrix} \quad 136$$

2. Three rotations:

$$\Theta_x = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos\theta_x & \sin\theta_x & 0 \\ 0 & -\sin\theta_x & \cos\theta_x & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad 140$$

$$\Theta_y = \begin{bmatrix} \cos\theta_y & 0 & -\sin\theta_y & 0 \\ 0 & 1 & 0 & 0 \\ \sin\theta_y & 0 & \cos\theta_y & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad 142$$

$$\Theta_z = \begin{bmatrix} \cos\theta_z & \sin\theta_z & 0 & 0 \\ -\sin\theta_z & \cos\theta_z & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad 138$$

3. Translate inwards:

$$T_b = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & -f & 1 \end{bmatrix} \quad 144$$

4. Effect of focal length on Perspective:

$$P = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1/f \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad 146$$

FIG._10C

Perspective Correction

Perspective Corrected Image Vertices given by:

$$\hat{p}_i = p_i T_a \Theta_z \Theta_y \Theta_x T_b P = [\underbrace{\hat{x}_i, \hat{y}_i, \hat{z}_i, \hat{w}_i}_{152}] \quad 150$$

But:

$$\begin{aligned} \hat{w}_i &= -\frac{x_i}{f} (-\sin\theta_z \sin\theta_x + \cos\theta_z \sin\theta_y \cos\theta_y) \\ &+ \frac{y_i}{f} (\cos\theta_z \sin\theta_x + \sin\theta_z \sin\theta_y \cos\theta_x) \\ &+ \cos\theta_y \cos\theta_x \end{aligned} \quad 152$$

and x'_i and y'_i from the perspective corrected image are given by:

$$x'_i = \frac{\hat{x}_i}{\hat{w}_i} \quad \text{and} \quad y'_i = \frac{\hat{y}_i}{\hat{w}_i} \quad 154 \quad 156$$

Therefore we can write:

$$F_{xi}(\theta_z, \theta_y, \theta_x, f) - x'_i = 0 \quad 158$$

Taking:

$$t = [\theta_x \quad \theta_y \quad \theta_z \quad f] \quad 160$$

We can write:

$$-F(t) = \begin{bmatrix} x_o - F_{x_o}(\theta_z, \theta_y, \theta_x, f) \\ y_o - F_{y_o}(\theta_z, \theta_y, \theta_x, f) \\ \cdot \\ \cdot \\ x_i - F_{x_i}(\theta_z, \theta_y, \theta_x, f) \\ y_i - F_{y_i}(\theta_z, \theta_y, \theta_x, f) \end{bmatrix} \quad 162$$

FIG. 10D

Newton's Method

By Newton's method of numerical computation, \mathbf{t} is an estimate of the values

$$[\theta_x \quad \theta_y \quad \theta_z \quad f]$$

then:

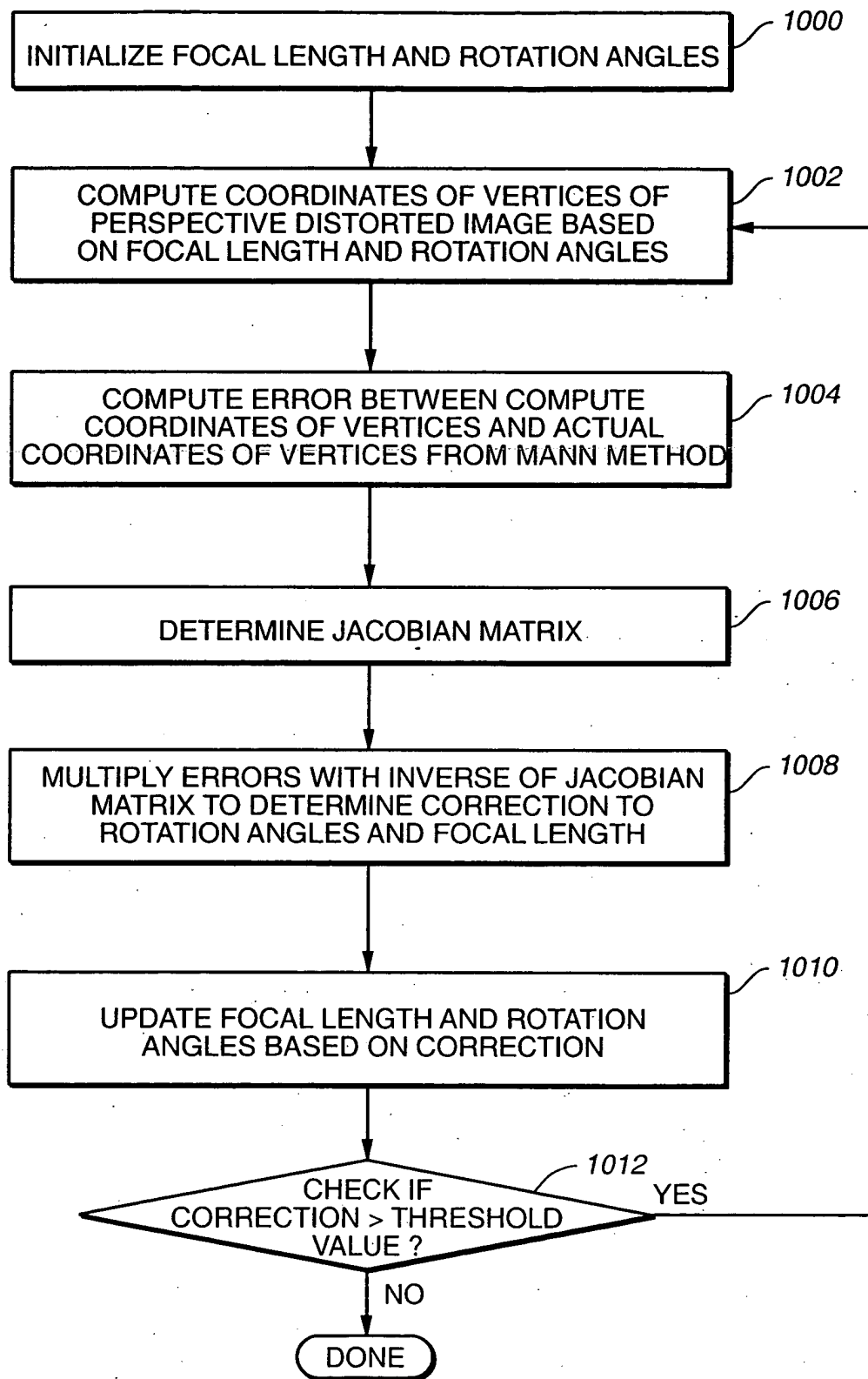
$$\mathbf{t}_{new} = \mathbf{t} - \mathbf{J}^{-1} \mathbf{F}(\mathbf{t}) \quad \text{166}$$

is a better estimate of the values.

Where \mathbf{J}^{-1} is the matrix of partial derivatives:

$$J_{ij} = \frac{\partial F_i}{\partial t_j} \quad \text{164}$$

FIG. 10E

**FIG. 11**

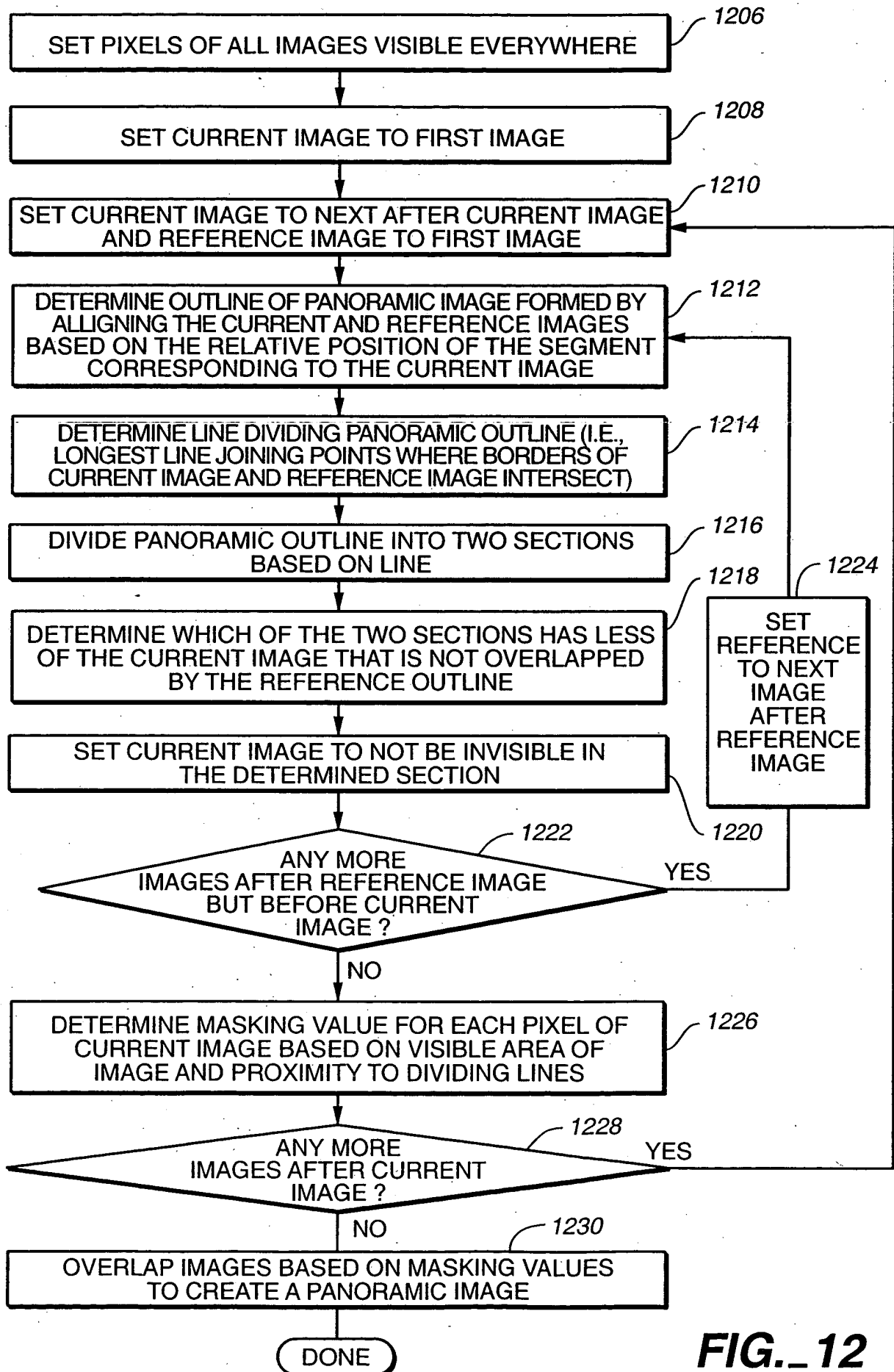


FIG. 12